**Chemical Reactions**

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| --- | --- | --- | --- | --- | --- |
| Test Question number | Question Type | Achievement chart | | | |
|  |  | Knowledge and Understanding | Thinking and inquiry | Communication | Application |
| #1-10 | True/False | √√√1-3, √7, √10 | √√4-5, √8 |  | √6, √9 |
| #11-30 | Multiple choice | √15, √21, √√√28-30 | √√√12-14, √16, √19, √22, √√23-24 |  | √11, √√17-18, √20, √√√25-27 |
| #31-35 | Completion | √√√√√31-35 |  |  |  |
| #36-42 | Short answer questions |  | √39, √√41-42 | √√38, √39 | √√√36, √√37 |
| #43-45 | Long answer questions |  |  | √√√√43, √√√√44, √√√45 |  |
| Total Marks |  | 5+5+4=15 | 3+2+3=14 | 14 | 2+7+1+5=14 |

Legend:

√ - one mark

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Question | Ministry Clusters | | | | | | | | | | | | | | | Evaluation of the mark (Total) |
|  | C1.1 | C1.2 | C2.1 | C2.2 | C2.3 | C2.4 | C2.5 | C2.6 | C2.7 | C2.8 | C2.9 | C2.10 | C3.1 | C3.2 | C3.3 |  |
| 1 |  |  | √ |  |  | √ |  |  |  |  |  |  |  |  |  | 1 |
| 2 |  |  | √ |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| 3 |  |  |  |  |  |  | √ |  |  |  |  | √ |  |  |  | 1 |
| 4 |  |  |  |  | √ | √ |  |  |  |  |  |  |  |  |  | 1 |
| 5 |  |  | √ |  |  |  |  | √ |  |  |  |  |  |  |  | 1 |
| 6 |  |  |  |  | √ |  |  |  |  |  |  |  |  |  |  | 1 |
| 7 |  |  |  |  |  |  |  | √ |  |  | √ |  |  |  |  | 1 |
| 8 |  |  |  |  |  |  |  |  |  |  |  | √ |  |  |  | 1 |
| 9 | √ | √ |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| 10 |  |  |  |  |  |  | √ |  |  |  |  |  |  |  |  | 1 |
| 11 |  |  | √ |  |  |  |  | √ |  |  | √ |  |  |  |  | 1 |
| 12 |  |  |  | √ | √ |  |  |  |  |  |  |  |  |  |  | 1 |
| 13 |  |  |  |  | √ | √ | √ | √ |  |  |  |  |  |  |  | 1 |
| 14 |  |  |  |  | √ | √ | √ | √ |  |  | √ |  |  |  |  | 1 |
| 15 |  |  |  | √ |  |  |  |  |  |  | √ |  |  |  |  | 1 |
| 16 |  |  |  |  |  |  |  |  |  |  | √ |  |  |  |  | 1 |
| 17 |  |  |  |  |  |  |  |  |  |  |  |  | √ |  |  | 1 |
| 18 |  |  |  |  |  |  |  |  |  |  |  |  | √ |  |  | 1 |
| 19 |  |  | √ |  |  |  |  | √ |  |  |  |  |  |  |  | 1 |
| 20 |  |  |  |  |  |  |  |  |  |  |  |  | √ |  |  | 1 |
| 21 |  |  |  | √ |  |  |  |  |  |  |  |  |  |  |  | 1 |
| 22 |  |  |  | √ |  |  |  |  |  |  |  |  |  |  |  | 1 |
| 23 |  |  |  |  |  |  | √ |  |  |  |  | √ |  |  |  | 1 |
| 24 |  |  |  |  |  |  | √ |  |  |  |  | √ |  |  |  | 1 |
| 25 |  |  |  |  | √ | √ |  |  |  |  | √ |  |  |  |  | 1 |

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| Test Question | Ministry Clusters | | | | | | | | | | | | | | | Evaluation of the mark (Total) |
|  | C1.1 | C1.2 | C2.1 | C2.2 | C2.3 | C2.4 | C2.5 | C2.6 | C2.7 | C2.8 | C2.9 | C2.10 | C3.1 | C3.2 | C3.3 |  |
| 26 |  |  |  |  |  |  |  |  |  |  |  |  | √ |  |  | 1 |
| 27 | √ |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| 28 |  |  |  |  |  |  |  |  |  |  |  |  | √ |  |  | 1 |
| 29 |  |  |  |  |  |  |  |  |  |  |  |  | √ |  |  | 1 |
| 30 |  |  |  |  |  |  | √ |  |  |  |  |  |  |  |  | 1 |
| 31 |  |  |  |  |  |  |  |  |  |  |  | √ |  |  |  | 1 |
| 32 | √ | √ |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| 33 |  |  |  |  |  |  |  |  |  | √ |  |  |  |  | √ | 1 |
| 34 |  |  |  |  | √ |  |  | √ |  |  |  |  |  |  |  | 1 |
| 35 |  |  |  |  |  |  |  |  |  | √ |  |  |  |  | √ | 1 |
| 36 |  |  |  | √ |  |  |  |  |  |  |  |  |  |  |  | 3 |
| 37 |  |  |  | √ |  |  |  |  |  | √ |  |  |  |  | √ | 2 |
| 38 |  |  |  | √ |  |  |  |  |  | √ |  |  |  |  | √ | 2 |
| 39 |  |  |  |  |  |  |  |  | √ |  |  |  |  | √ |  | 1 |
| 40 |  |  |  |  |  |  |  |  | √ |  |  |  |  | √ |  | 1 |
| 41 |  |  |  |  |  |  |  |  | √ |  |  |  |  | √ |  | 1 |
| 42 |  |  |  |  |  |  |  |  | √ |  |  |  |  | √ |  | 1 |
| 43 | √ | √ |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| 44 | √ | √ |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| 45 | √ | √ |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Total | 6 | 5 | 5 | 7 | 7 | 5 | 7 | 7 | 4 | 4 | 6 | 5 | 6 | 4 | 4 | 57 |

C1. analyse chemical reactions used in a variety of applications, and assess their impact on society and

the environment;

C2. investigate different types of chemical reactions;

C3. demonstrate an understanding of the different types of chemical reactions.

C1.1 analyse, on the basis of research, chemical reactions used in various industrial processes (e.g., pulp and paper production, mining, chemical manufacturing) that can have an impact on the health and safety of local populations [IP, PR, AI, C]

Sample issue: Base metal smelting produces useful metals such as zinc, lead, copper, and nickel directly from their ores. However, during smelting, harmful compounds can be released into the environment, including cadmium, arsenic, sulfur dioxide, and mercury, all of which can endanger the health and safety of local populations.

Sample questions: What are some chemical reactions used in the manufacture of paper? How might the reactants or products of the pulp and paper production process affect the health of people living near the plant? In what ways might the leaching of chemicals from tailing ponds affect the water quality in a local community? In what ways do toxic chemical fires affect local communities?

C1.2 assess the effectiveness of some applications of chemical reactions that are used to address social and environmental needs and problems [AI, C]

Sample issue: Scrubber systems are a group of air pollution control devices used by industry to remove or neutralize acid exhaust gases before they reach the atmosphere. Scrubber technologies help to reduce acid precipitation, but there are many different scrubbing techniques with varying levels of effectiveness in controlling acid gas emissions.

Sample questions: How are chemical reactions used to remediate environments affected by chemical spills? How can tailing ponds be rehabilitated to lessen the effects of hazardous chemicals on plant populations? What types of chemical reactions can change a toxic chemical into one that is less toxic or non-toxic?

C2.1 use appropriate terminology related to chemical reactions, including, but not limited to: neutralization, precipitate, acidic, and basic [C]

C2.2 write balanced chemical equations to represent synthesis, decomposition, single displacement, double displacement, and combustion reactions, using the IUPAC nomenclature system [PR, AI, C]

C2.3 investigate synthesis, decomposition, single displacement, and double displacement reactions, by testing the products of each reaction (e.g., test for products such as gases, the presence of an acid, or the presence of a base) [PR, AI]

C2.4 predict the products of different types of synthesis and decomposition reactions (e.g., synthesis reactions in which simple compounds are formed; synthesis reactions of metallic or non-metallic oxides with water; decomposition reactions, in which a chemical compound is separated into several compounds) [AI]

C2.5 predict the products of single displacement reactions, using the metal activity series and the halogen series [AI]

C2.6 predict the products of double displacement reactions (e.g., the formation of precipitates or gases; neutralization) [AI]

C2.7 design an inquiry to demonstrate the difference between a complete and an incomplete combustion reaction [IP, C]

C2.8 plan and conduct an inquiry to compare the properties of non-metal oxide solutions and metal oxide solutions (e.g., carbon dioxide reacts with water to make water acidic; magnesium oxide reacts with water to make water basic) [IP, PR, AI]

C2.9 investigate neutralization reactions (e.g., neutralize a dilute solution of sodium hydroxide with a dilute solution of hydrochloric acid, and isolate the sodium chloride produced) [PR]

C2.10 plan and conduct an inquiry to demonstrate a single displacement reaction, using elements from the metal activity series [IP, PR]

C3.1 identify various types of chemical reactions, including synthesis, decomposition, single displacement, double displacement, and combustion

C3.2 explain the difference between a complete combustion reaction and an incomplete combustion reaction (e.g., complete and incomplete combustion of hydrocarbon fuels)

C3.3 explain the chemical reactions that result in the formation of acids and bases from metal oxides and non metal oxides (e.g., calcium oxide reacts with water to produce a basic solution; carbon dioxide reacts with water to produce an acidic solution)